

# **From Shuttle Main Engine to the Human Heart:**

## **A Presentation to the Federal Lab Consortium for Technology Transfer**

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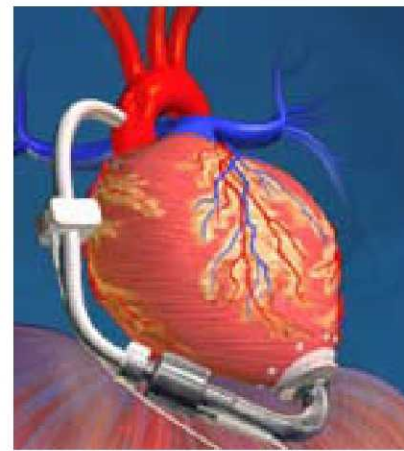
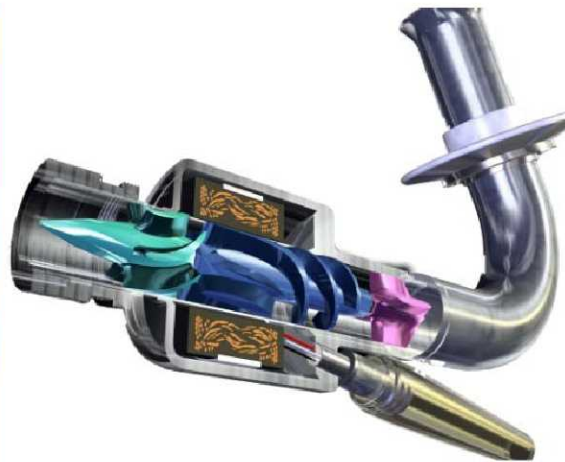
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Pictures Courtesy of NASA and MICROMED Cardiovascular Inc.

# How it all began...

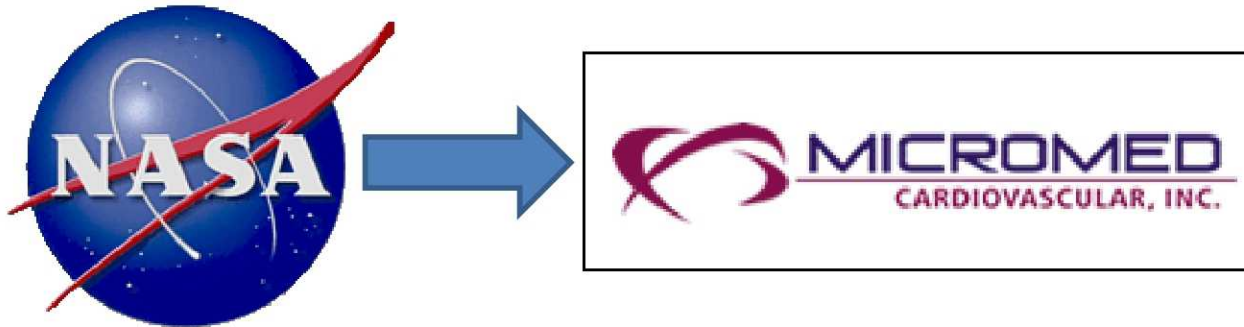
- A NASA engineer received a heart transplant performed by Drs. DeBakey and Noon after suffering a serious heart attack
- 6 months later that engineer returned to work at NASA determined to use space technology to help people with heart disease
- A relationship between NASA and Drs. DeBakey and Noon was formed and the group worked to develop a low cost, low power implantable ventricular assist device (VAD)





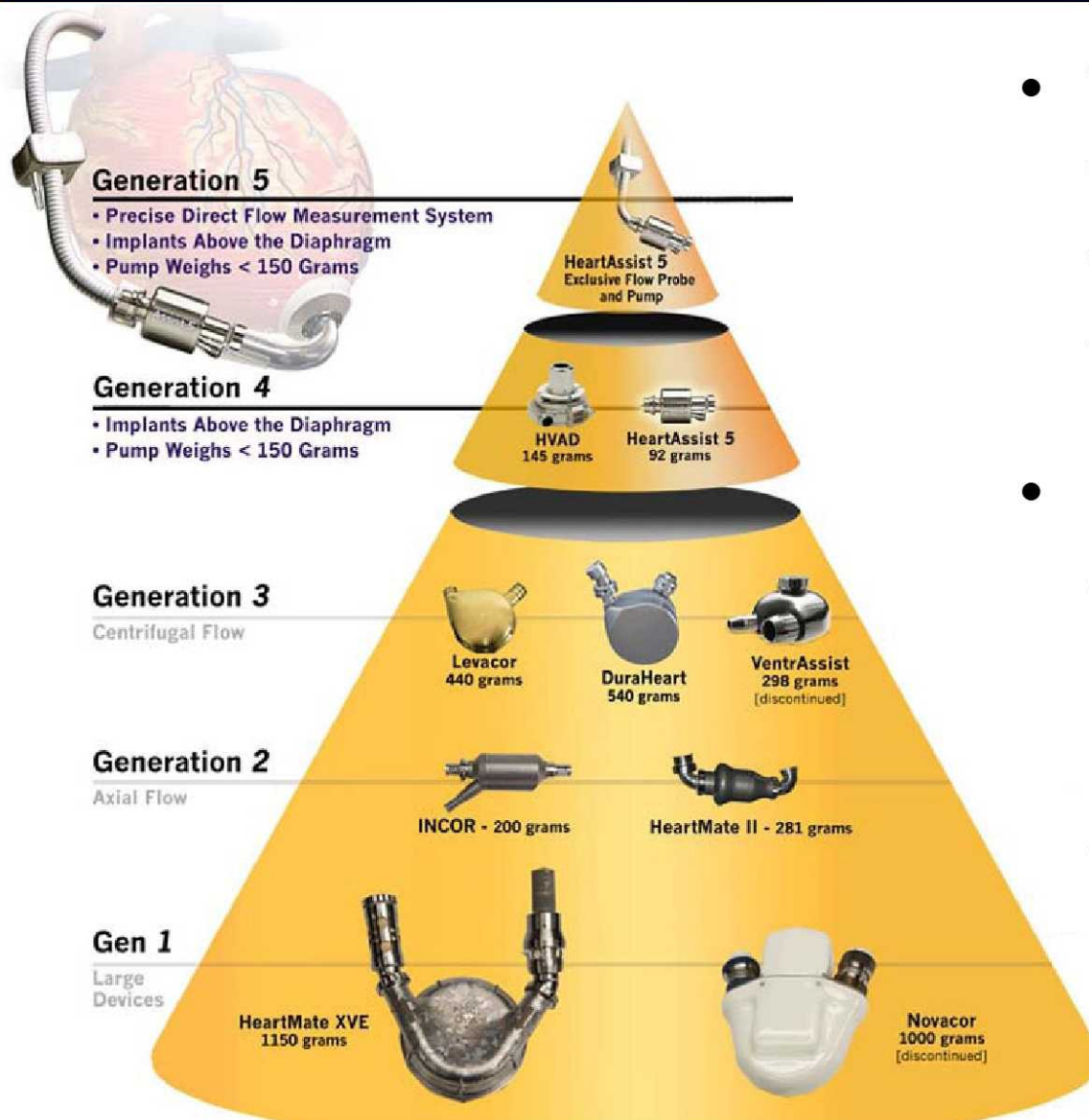
# The Tale of Technology Transfer

- NASA patented the method to reduce pumping damage to red blood cells and the design of a continuous flow heart pump (#5,678,306 and #5,947,892)
- The technology and methodology were licensed exclusively to MicroMed Technology , Inc
- In late 1998 MicroMed received international quality and electronic certifications and began clinical trials in Europe





# VAD: Past and Present



- Ventricular assist devices were developed to bridge the gap between heart failure and transplant
- Early devices were cumbersome, damaged red blood cells, and increased the risk of developing dangerous blood clots



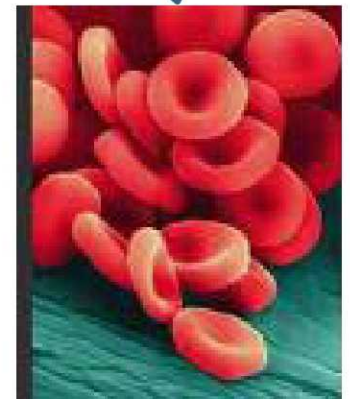
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How did NASA technology and analysis impact the evolution of the VAD?



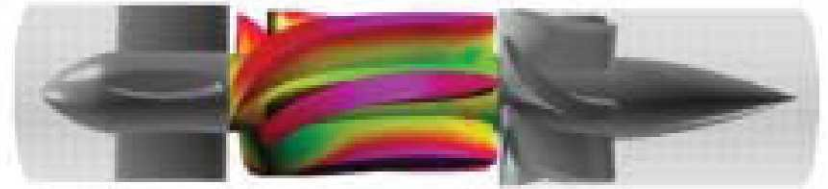
# From Rocket Fuel to Blood

- Application emerged from NASA turbopump technology and computational fluid dynamics analysis capabilities
- To develop the high performance required of the Space Shuttle main engines, NASA pushed the state of the art in the technology of turbopump design
- NASA supercomputers and computational fluid dynamics software developed for use in the modeling and analysis of fuel and oxidizer flow through rocket engines was used in the miniaturization and optimization of a very small heart pump



# Good, Better, Best

- The original ventricular assist device, top, and the after modifications by NASA, center and bottom
- Adding an inducer to the MicroMed DeBakey VAD<sup>®</sup> eliminates dangerous back flow by increasing pressure and making flow more continuous
- The device is subjected to the highest pressure around the blade tips, shown in magenta

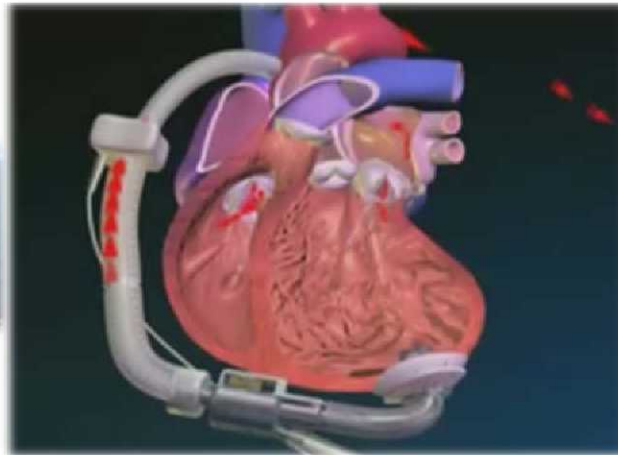




# A Bridge or a Destination



- Approximately 5 million people worldwide suffer from chronic heart failure at a cost of 40 billion dollars
- In the US, more than 5000 people are on the transplant list and less than 3000 transplants are performed each year due to the lack of donors
- The success of ventricular assist devices has led to an application as a therapeutic destination as well as a bridge to transplant
- This success has been attributed to smaller size, improved efficiency, and reduced complications such as the formation of blood clots and infection







# MicroMed VAD

- Adult and Pediatric HeartAssist 5 Device is approved for clinical use in the European Union
- Pediatric HeartAssist 5 is FDA approved
- Over 440 implants worldwide accounting for more than 130 patient years of life
- Clinical testing is underway in the US on the Adult HeartAssist 5

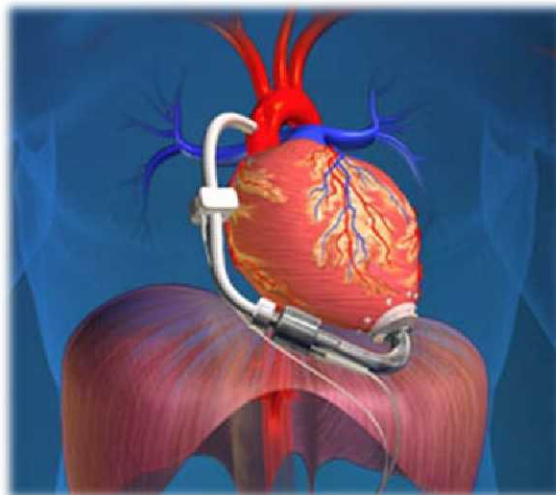
**92 Grams**

World's Lightest & Smallest VAD



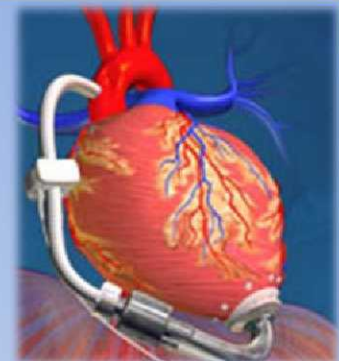
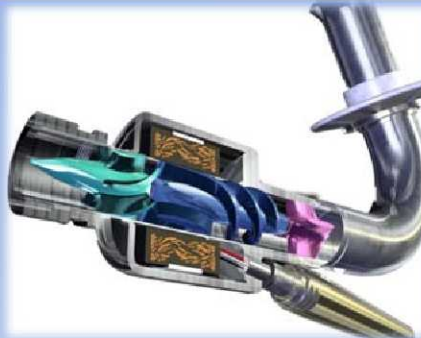
# The Future of the VAD

- Transcutaneous induction to power the device rather than percutaneous cables = reduced risk of infection and more patient freedom
- NIH funding MicroMed for the development of an artificial heart through the use of both a left and right ventricular assist device





# Thank You!



# Questions?

